

Agriculture and Water in China

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There is an old Chinese saying about water. It goes like that: “Crying with no water but fertilizer and half of the harvest with no fertilizer but water”. In general, water is the lifeline of agriculture in China. There would be no agriculture without water, not to mention the prosperity of agriculture in the country nowadays.

1. Water Resources in China

China is a country of water scarcity with serious imbalanced distribution of timing and location of precipitation. The total annual water resources available are 2 800 billion m³. It means that per capita water is less than 2 400 m³, just equal to 1/4 of the world average. Its fresh water resources only account for 8 % of the world total. That is why China is one of the 13 countries on the water scarcity list of the world. On timing of precipitation, 70 % of the annual precipitation focus on the 4 months of June, July, August and September. In other words, it comes mainly in summer and autumn rather than winter and spring and in the form of storm, making it difficult to use. On its location, most water resources concentrate in the southeastern part rather than northwestern part of the country. Water resources located in the Yangtse River valley and the southern parts to the river make up over 82% the total while farmland there only 36% of the total. In contrast, water resources found in the northern parts to the river account for less than 18% of the total while the farmland up to 64% of the total. Owing to such serious imbalance, in the same season some areas suffer from drought, another ones flooding and the others drought after flooding.

The major natural disasters agriculture suffers are flooding and drought. According to historical records, during the years of 2 155 from 206 BC up to 1949, the country suffered serious droughts of 1 056, twice every year. And from 1950 to 1989, on the average the annual acreage of farmland suffered from flooding totaled 8 million ha (120 million mu), 20.66 million ha (310 million mu) from drought. In 1990s, the annual drought-affected acreage increased to 25.33 million ha (380 million mu), and still in the trend of increasing. Water scarcity has created various problems. For example, a. Vast farmland and pasture have gone to barren waste and land desertification increased at the rate of 2 460 km² a year. b. Excessive-exploitation of under-ground water has caused earth subsidence and dried rivers in some areas. In 1972, happened the first cut-off of Yellow River, and then it has repeated each year ever since 1985. In 1997, the total days of

cut-off were 226. c. Nearly 2/3 farmland has remained low or middle yield for a long time, of which 30% are rain-fed fields. In the past 10 years, the annual water shortage averaged above 30 billion m^3 in the irrigated farming areas suffering from medium drought and the grain output reduced by over 30 billion kg. In case of more serious drought year, farming production would suffer greater losses. To a great extent, good or poor harvest depends on seriousness of drought, flooding and the affected acreage.

2. Farmland irrigation works have attracted a lot of attention in agricultural development

Given to the special importance of water in farming production, China has always regarded water as a major factor in policy making. The agricultural history is in fact a history of fighting against natural disasters of both drought and flooding. As far back as 200 BC, a great water conservancy work of Dujiang Yan irrigation system was built up. Since 1949 when the new Chinese government was set up, it has always put the problem of agricultural water use on the top of its agenda. The government has implemented many water conservancy projects to harness rivers, control and store flood, promote irrigation and improve saline and alkaline soil. Set up are over 80 000 reservoirs, more than 3 million pump wells, nearly 6 000 pieces of irrigated areas with more than 10 000 mu each. Irrigated farmland has expanded to 50 million ha (750 million mu), including 33 million ha (over 500 million mu) of stable high-yield field in spite of drought or flooding. Development of farmland water conservancy has played a critical role to ensure successive bumper harvests and 500 million tons of grain production, making it possible to feed 22% of the world population with less than 10% of the world farmland. It may be said that there would be no prosperous agriculture without development of agricultural water conservancy.

3. Severe situation of water use in agriculture

In spite of a tremendous achievement made in the development of agricultural water conservancy, still the need of agriculture and social development has not been satisfied. At present, irrigation water use accounts for 3/4 of the total. However, about half of it lost in transmission and flooding irrigation caused waste of almost half of the water in the field due to leakage or evaporation. As a result, the effective use of water only accounts about 1/3 of the total irrigation water. Nowadays, 1 m^3 of water can just produce about 1 kg of grain, far from that of developed countries.

By the 21st century, agriculture in the country must meet the requirements of farm produce by an increased population of 400 million. On the basis of 1 kg of grain/1 m^3 of water, at least hundreds of billions cubic meters of irrigation water would be needed to produce such amount of grain. However, with increased population, urbanization and economic development as well as

impacts of comparative effectiveness, urban development and industry of water requirements must be satisfied first. In such a situation, it would be difficult to increase water supply to agriculture. In addition, the ratio of water supply to agriculture would decrease further to make the problem of agricultural water use get worse.

It is imperative to speed up improvement of effective use of water to solve the problem of insufficient water supply to agriculture, which has great concern with agricultural development in the 21st century.

4. Major ways to improve water use in agriculture and potentials in this aspect

Opening up water resources should be integrated with decreasing water use. Water saving agriculture shall be developed through water collection, retaining, saving and management to make maximum use of precipitation, surface water, underground water and soil moisture. Dryland farming should be developed in areas where no water resources could be found. The major ways to improve water use in agriculture are as follows:

- 1.✱To collect and store precipitation. First, small and medium-sized reservoirs should be reinforced and dredged. There are more than 80 000 big, small and medium-sized reservoirs with a total designed storage capacity of 470 billion m³. However, the effective storage capacity is about 30 billion m³ less due to serious silting up. Over 25 billion m³ of storage capacity could be restored if silt is cleaned up. Second, small mountain ponds, cisterns and pools should be built up to collect and store precipitation and to expand water storage capacity as well as irrigation acreage. These measures are suitable to mountainous areas and loess plateaus in the northwestern parts of the country where is short of surface or underground water and the annual precipitation is less 300 mm. They are also good for the rural responsibility system. For instance, some trail areas with annual precipitation of less than 500 mm have managed to irrigate effectively by collecting and retaining rainfalls, so as to raise grain output by two times. Third, efforts should be made to set up terraced fields, plough deeply, plant trees, promote dryland farming and build up underground reservoirs to collect and retain precipitation, protect water sources and prevent erosion of water and soil.
- 2.✱To put a stronger lining to canals and ditches against leakage so as to reduce water lost in transmission. At present, the length of lined canals and ditches accounts for only about 20% of the total. Most of them are simply made of earth, having serious problems of leakage and evaporation. On the average, the effective transmission rate of water could only 40% to 50%.
- 3.✱To introduce advanced water saving techniques to improve efficiency of water use in the field.

At present, the acreage of sprinkling and drip irrigation makes up less than 2% of the total irrigated acreage. According to calculation, every 10 percentage points raised in effective use of field irrigation could save 40 billion m³ of water and increase 6.66 million ha (100 million mu) of irrigated farmland. More than 80 billion m³ of water could be saved if the water use ratio of field irrigation would be increased to around 60% from the present 40%. Should all the saved water be used for irrigation, it is possible to increase more than 13.33 million ha (200 million mu) of irrigated farmland.

By so doing, the effective irrigated farmland would be increased to over 66.66 ha (1 billion mu) from the present over 46.66 ha (more than 700 million mu) and the water requirements for producing enough grain to feed 1.6 billion population by the middle of 21st century would be satisfied.

4. To select and introduce water saving techniques for dryland farming all over the country.

- 1.✱To set up matching facilities for water saving farming and high efficiency-irrigation in large and medium-sized irrigation areas. Now, there are 220 large irrigation areas with over 300 000 mu of farmland each and many medium-sized ones with tens of thousands to hundreds of thousands of farmland each. They are built up in relative flat areas with water sources and water supply facilities. The matching facilities for water conservancy works have been changed from canals and ditches for flooding irrigation to water saving transmission and irrigation by using water saving techniques, pipe transmission, sprinkling or pipe irrigation.
- 2.✱To introduce water saving techniques such as pipe transmission, spray, pipe and drip irrigation to pump well irrigation areas in the northern parts of the country. This kind of water saving techniques requires small investment, produce quick returns and increase output at a big margin. In addition, they are easy to be used by farmers.
- 3.✱To build up or repair small reservoirs, mountain ponds, cisterns, pools and ditches to retain water and prevent water leakage. Areas with favorable conditions should adopt water saving techniques such as pipe transmission and irrigation, drip or sprinkling irrigation to expand effective irrigated farmland.
- 4.✱To collect rainfalls and adopt techniques of pipe irrigation and drip irrigation mainly in arid or semi-arid areas. Effective use of precipitation should be improved by building up small cisterns, mountain ponds and pools to retain and store rainfalls.
- 5.✱To carry out matching projects of ditch or canal and field irrigation in paddy rice producing

areas plus introduction of water saving irrigation techniques for paddy rice fields. This set of techniques does not require additional investment or equipment and is easy to accept and use by farmers.

6. ~~To~~ To introduce spray, micro-sprinkling and drip irrigation to orchards, vegetable fields and green houses.

7. ~~To~~ To set up 300 demonstration counties for introducing water saving techniques. The purpose of so doing is to make preparation for promote water saving efforts in all parts of the country through publicity, training courses, building up of institution, stronger laws and regulations and standardized management.

It is our major strategic policy to accelerate the development of China's agricultural infrastructure focusing on water conservancy, develop water-saving dryland farming technology, improve water use efficiency, expand effective irrigated area, put an end to water waste under traditional, extensive farming system and solve the problem of water shortage in China's agriculture. It is also a major measure for China's agriculture in the 21st century to become more specialized, commercialized and modernized. Agricultural issue in China is actually a world issue and a good solution to China's agricultural problem represents a major contribution to the world agricultural as a whole. The Chinese people under the support of the international community have made great efforts to this end and we hope to get further support and assistance from the international community, particularly from developed countries like the US. We are ready to cooperate in the research of water-saving irrigation machines and equipment, drought-resistant varieties and other matching technology so as to speed up the development of China's dryland agriculture and contribute to agricultural development in the world.